REMARKS

Claims 1-15 remain pending in the application. Claims 1-13 have been amended.

Applicants note with appreciation the allowance of claim 15.

Claims 1-14 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Loo (U.S.P. 6,331,257) in view of Fisher (U.S.P. 4,132,487)

Applicants submit that even when taken independently, Loo's and Fisher's teachings are unrelated to the teaching of the Applicants. More specifically:

Loo teaches a micromechanical switch with a flexible beam anchored on one end and making and breaking electrical contact on the other, free end. The switch is closed by the application of a voltage to a third terminal, which creates an electric field between this terminal and the beam, thus attracting the beam and deforming it so that the free end lands on the electrical contact.

Applicants, on the other hand, teach how to construct the contact itself and how the spring constant of the deformable switch is controlled to create a relationship between the required actuation voltage of the switch and the potential for contact sticking or "stiction."

Loo's switching device teaches away from the device taught by the Applicants for the following reasons:

1) Loo's electrical contact consists of a metal pad on the substrate and a metal dimple (bump) on the underside of the end of the deformable beam such that when the switch is actuated and closed the two metals touch, closing the switch.

2) Since the metal dimple descends below the lower surface of the beam, it touches the metal landing pad and makes contact before the middle of the beam reaches the actuation electrode. Alternatively, the gap between the dimple and the contact pad is smaller than the gap between the beam and the actuator electrode. This means that after electrical contact is made, the beam continues to bow downward in the middle until the beam center finally contacts the actuator electrode. Thus, the restorative force for this switch is set by the difference in size between the contact gap and the actuator gap as well as by the flexibility of the beam.

From the foregoing, Loo teaches strictly a metal contact and controls the way the beam flexes in order to control the nature of the restorative force. The means of contacting and the means of controlling the restorative force are wholly decoupled and unrelated from one another. No compressible, conductive material is employed for the contact. The compressibility of the contact electrode material itself plays no role in determining the linearity of the restorative force of the switch.

Now, referring to Fisher, what is taught is:

1) A keyboard switch consisting of a plunger which moves up and down and which includes a special underside contact surface that comes in close proximity to a special contact surface on a substrate as the plunger is depressed.
2) The underside of the switch is coated first with a compressible foam and finally with a conductive elastomer.
3) The substrate below the plunger contains two traces of metal that cause the switch to be connected to each other, closing the switch. One of the traces has an exposed metal bump thereon while the other is coated with an insulator.
4) When the switch closes, the elastomer touches both the exposed metal bump on one electrical terminal and an insulating coating on the other. This creates a capacitor that allows pulses or alternating-current signals to pass through.

The Office Action states that it would be obvious to take the coating, taught by Fisher and apply it to the contact element on the beam of the switch taught by Loo. Applicants traverse this assertion since the elastomer taught by Fisher cannot be transposed to the device taught by the Applicants

More particularly, Fisher's teaching is limited to an elastomer that accommodates the difference in surface topology of the electrical terminals on the substrate in order to "insure uniform contact with the conductive elements for a uniform capacitive coupling upon operation" (line 31). Recalling that one terminal features a raised bump and the other is coated with a dielectric, the height of these two surfaces needs not be the same, especially in a manufacturing environment. Thus, Fisher's elastomer is flexible enough to ensure contact across two terminals at somewhat different heights.

Applicants submit that the role of the elastomer as taught by the Applicants is completely missed. Applicants' elastomer has a restorative force of its own which can be tailored and leveraged to alter the overall restorative force of the switch. This teaching is absent in Fisher as is the place where it needs to be in order to provide the necessary restorative force. More specifically, Fisher's current is conducted laterally along the elastomer, requiring a continuous material. This teaches away from the Applicant's invention. If one were to combine Loo and Fisher, the resulting device would fail to teach or at least suggest the teaching taught by the Applicants, namely:

1) The use of any of several conductive, compressible elements, including "springs" of metal or silicon formed by etching. Fisher can only use a continuous sheet of material. Applicants require material types where conduction is vertical, along the "thickness" direction, not in a lateral direction. By combining the etched springs of Fisher incorporated in Loo's would generate a device that is inoperable. Not so, for Applicant's MEMS switch.
2) Applicants teach the use of a restorative force of the compressible, conductive element in combination with that of the deformable beam to form a specific type of nonlinear restorative force that is initially weak but which becomes strong once

contact is made. This means that the restorative force is greatest when the gap between the beam and the actuator electrode is smallest, keeping th actuation voltage low – a key principle in Applicant's teaching and conspicuously absent in the combination of Loo with Fisher.

In conclusion, the Office Action states it would be obvious to select materials in order to create sufficient restorative force to avoid stiction. However, the prior art suggests otherwise. When materials with spring constants sufficient to achieve good restorative force are used, a high actuation voltage is required to overcome this force and close the switch. When a low force is selected to allow a low voltage, the force is insufficient to open the switch reliably. This is a classic design tradeoff that has not been definitively solved in the industry. Applicants address this problem by creating *two* restorative forces. For most of the switch closing cycle, the force is small and the voltage is thus small as well. Once the compressible, conductive element touches the contact electrode, however, the force changes drastically and becomes large. This allows stiction to be overcome. However, since the actuator electrode gap is small at this point, it does so without requiring an increase in actuation voltage. Accordingly, Applicants teach how to circumvent this problem.

Finally, by allowing claim 15, which stacks multiple compressible materials with different spring constants to form a tailored, a non-uniform spring constant implicitly accepts the specific case of two materials with different spring constants. Claims 1-14 are just for such a case where the beam contributes one force and the compressible contact another, creating a tailored force profile. Claim 15 just extends this beyond two. The allowance of Claim 15 would therefore seem indicative that Claims 1-14 should, likewise, also be patentable over the combination of Loo and Fisher.

Notwithstanding the foregoing arguments and in order to advance the prosecution of the present application, Applicants have opted to incorporate in the independent claims the limitations stated above that are directed to the the restorative forces to overcome stiction and the use of the elastometer to achieve this purpose.

Accordingly, Applicants believe that the amended claims are patentable over the combination of Loo and Fisher, and respectfully request that the Examiner reconsider and withdraw the rejection of claims 1-14 based on 35 U.S.C. 103(a).

Accordingly, Applicants believe that all the active claims are now in condition for allowance, and respectfully request that the Examiner enter the amended claims; that all the rejections and objections to this application be reconsidered and withdrawn; and that the Examiner pass all the pending claims to issue.

Should the Examiner have any suggestions pertinent to the present application, the Examiner is encouraged to contact Applicants' undersigned representative at the number shown below.

No fee is believed to be due for this submission. If any fees are required, however, the Commissioner is hereby authorized to charge such fees to Deposit Account No. 09-0458.

Respectfully submitted,
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